

# UK Patent Application GB 2 187 042 A

(43) Application published 26 Aug 1997

(21) Application No 8604346

(22) Date of filing 21 Feb 1986

(71) Applicant

The Plessey Company plc,

(Incorporated in United Kingdom),

Vicarage Lane, Ilford, Essex IG1 4AQ

(72) Inventor

Ronald Henry Charles Jolly

(74) Agent and/or Address for Service

G. Sorenti, The Plessey Company plc, Intellectual Property  
Dept., Vicarage Lane, Ilford, Essex IG1 4AQ

(51) INT CL<sup>4</sup>  
H03H 7/38

(52) Domestic classification (Edition I)  
H1Q HC

(56) Documents cited

GBA 2148605 GB 0845352  
GBA 2148604 GB 0297434  
GBA 2132023

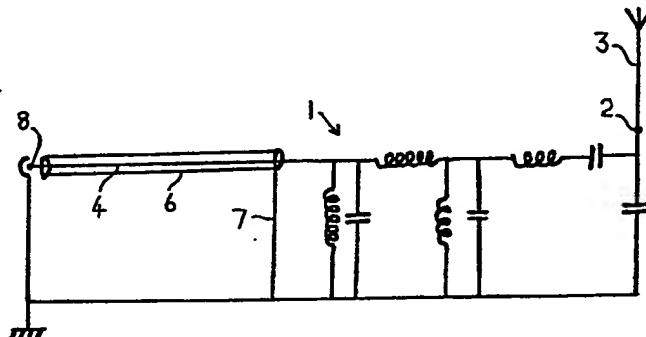
(58) Field of search

H1Q  
Selected US specifications from IPC sub-class H03H

(54) Impedance matching circuit for an aerial

(57) In an impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network (1) of inductors and capacitors via which the aerial (3) is fed, the matching circuit includes a predetermined length of a coaxial line (4, 6) by which signals for transmission are fed to the network or signals are fed from the network to a receiver. The length of the coaxial transmission line (4, 6) is selected to control signal phase shift and give a variable impedance over a wide frequency band.

This circuit allowed losses in the signal strength to be reduced so that the effective range of the aerial could be increased.



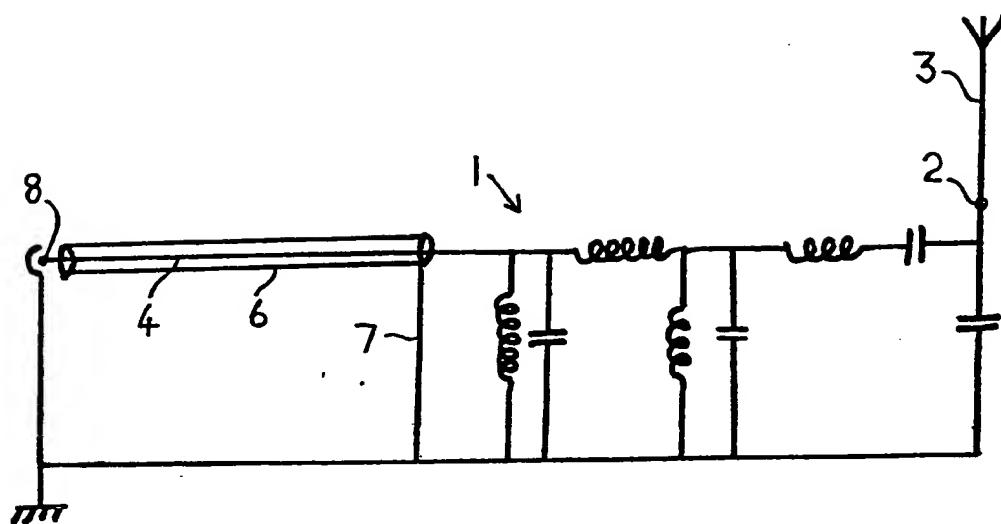
GB 2 187 042 A

ORIGINAL

D F A

2187042

1/1



**SPECIFICATION****Impedance matching circuit**

- 5 This invention relates to an impedance matching circuit. It relates particularly to a circuit which is capable of being used with an aerial for transmission or reception purposes and which is able to effect the aerial matching requirements with a minimum of  
 10 attenuation such that the efficiency of the aerial system can be increased.

In the construction of an aerial system for a radio transmitter/receiver one aerial design that might be used is that of a wideband end fed whip antenna. The  
 15 aerial matching circuit usually consists of a transmission line having a characteristic impedance, loss and length which is selected to minimise the loss requirement. This transmission line provides an impedance match between a simple matching circuit loaded with the end fed antenna and the radio  
 20 transmitter/receiver. However, the use of such a fixed attenuator can bring a disadvantage in that the load presented by the antenna varies rapidly with frequency and the loss which is introduced, and  
 25 which is dependent on the load impedance presented to it, can become very large.

The matching circuit of the invention was devised to provide an alternative attenuator construction which is frequency and phase dependent and which  
 30 can enable the radiating efficiency of the antenna system to be increased.

According to the invention, there is provided an impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network of inductors and capacitors via which the aerial is fed, the matching circuit further including a predetermined length of a coaxial line by which signals for transmission are fed to the network or signals are fed from the network to a receiver, the length being chosen so as to afford a predetermined phase shift in the signal effective to minimise signal losses in the circuit.

Preferably, the coaxial line is a lossy transmission line with a length chosen to provide the minimum  
 45 attenuation and optimum phase correction between a radio communication apparatus and the network of inductors and capacitors.

The impedance matching circuit may be constructed as part of a radio communication apparatus. An aerial associated with the apparatus may be of an end fed whip antenna construction.

By way of example, a particular embodiment of the invention will now be described with reference to the accompanying drawing, the single figure of which  
 55 shows a circuit diagram of the impedance matching circuit.

As shown in the Figure, the impedance matching circuit comprises an inductor/capacitor network 1 having an output terminal 2 to which an aerial 3 is connected. At a left hand end of the network 1, the network is connected to an inner conductor 4 of a length of coaxial transmission line. An outer sheath 6 of the line is joined to earth by means of the lead 7.

The left hand end of the inner conductor 4 is secured to an input terminal 8 for the impedance

matching circuit.

In operation of the impedance matching circuit, the input terminal 8 is connected to an output terminal of a radio transmitter (not shown). The  
 70 output terminal 2 of the matching circuit is connected to the aerial 3 which in this example is an end fed whip antenna.

In a conventional impedance matching circuit which makes use of a fixed attenuator having a  
 75 nominated input and output impedance, the load presented to the circuit by the antenna varies rapidly with frequency. Consequently, the signal loss which is introduced by the fixed attenuator, being dependent on the load impedance presented to it,

80 becomes very large.  
 In contrast to this, in the matching circuit of the invention, the attenuator which is embodied in the length of transmission line (4, 6) is both frequency and phase dependent such that the degree of  
 85 attenuation depends on the requirements demanded by the antenna impedance in relation to the requirements of the impedance of the matching circuit. Thus the impedance matching requirements over a wide frequency range are achieved with only a  
 90 minimum level of attenuation. This gives an increase in the radiating efficiency of the antenna system.

The length of the transmission line (4, 6), and thus the phase shift and signal loss level of the transmission line, is chosen so as to minimise the  
 95 variable impedance whilst keeping the loss as low as possible. By this means, it is found possible to reduce the standing wave ratio as seen by the transmitter to less than 3.5:1 using a reference of 50 ohms with a 1.4 metre length of whip antenna, and to  
 100 less than 5:1 using a 1/2 metre length of whip antenna.

It will be clear that whilst this embodiment has been described particularly as an impedance matching circuit for use with a ratio transmitter, the  
 105 construction applies equally to use of the matching circuit with a radio receiver. The use of the matching circuit enables the radiating efficiency of the antenna system to be increased so that an increased transmission or reception range can be achieved.

110 The foregoing description of an embodiment of the invention has been given by way of example only and a number of modifications may be made without departing from the scope of the invention as defined in the appended claims. For instance, where it is  
 115 required to couple together different units of a radio frequency communication system and there is a limitation on the level of signal attenuation that is permitted, the impedance matching circuit of the invention could be used with advantage.

**120 CLAIMS**

1. An impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network of inductors and capacitors via which the aerial is fed, the matching circuit further including a predetermined length of a coaxial line by which signals for transmission are fed to the network or  
 125 signals are fed from the network to a receiver, the

- length being chosen so as to afford a predetermined phase shift in the signal effective to minimise signal losses in the circuit.
2. A matching circuit as claimed in Claim 1, in  
5 which the said coaxial line is a lossy transmission line with a length chosen to provide the minimum attenuation and optimum phase correction for signals passing between a radio communication apparatus and the said network of inductors and  
10 capacitors.
3. Radio communication apparatus including an impedance matching circuit as claimed in Claim 1 or  
2.
4. Radio communication apparatus as claimed in  
15 Claim 3, including an end fed whip antenna aerial construction.
5. An impedance matching circuit substantially as hereinbefore described with reference to the accompanying drawing.

---

Printed for Her Majesty's Stationery Office by  
Croydon Printing Company (UK) Ltd, 7/87, D8991685.  
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,  
from which copies may be obtained.